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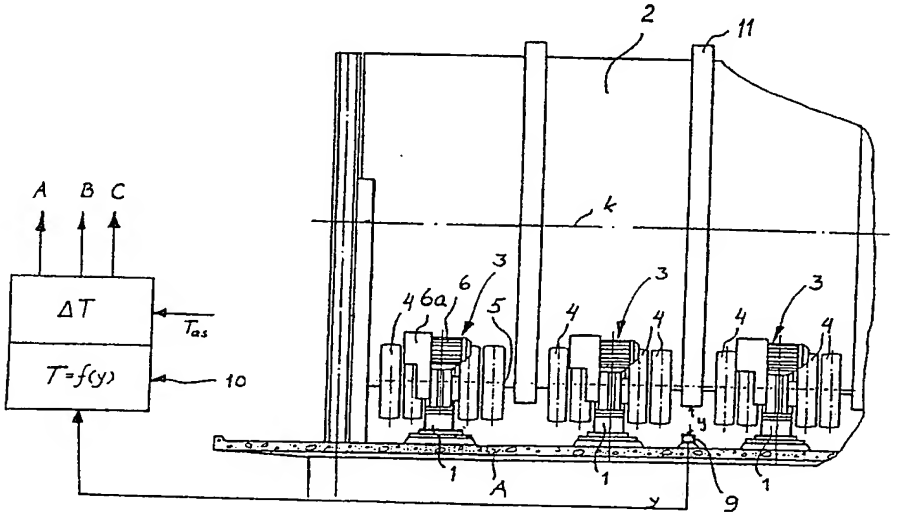
(54) Title: METHOD IN THE PROCESS OF TIMBER DEBARKING

(57) Abstract

The invention relates to a method in the process of timber debarking, whereby the debarking apparatus used comprises a rotary cylindrical drum (2), preferably equipped with transfer elements therein. The logs are conveyed from the feed end to the exit end of the cylindrical drum (2), the bark being thus separated from the trunk part of the logs. The cylindrical drum (2) is supported on a solid frame (1) by elements (4) which are suitably arranged to rotated substantially around the longitudinal axes of the cylindrical drum and at least part of them are flexible. The debarking apparatus comprises also drive means (6, 6a) for effecting the rotational movement of the cylindrical drum (2). The method is used particularly to measure the volumetric efficiency in order to control the process quantities of the debarking process. In the method, the control logistics of the volumetric efficiency are chosen according to the process quantities, particularly the elected barking strategy, in a way that they are dependent on the change of form of the flexible means (4). According to the method, the change of form of the flexible elements (4) - at least one of them - is measured preferably continuously during the use of the debarking apparatus for use in achieving at least one control quantity (A, B, C) according to the barking strategy.



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Method in the process of timber debarking

The invention relates to a method in the process of timber debarking. In the method, the debarking apparatus used comprises a rotary cylindrical drum, preferably equipped with transfer elements therein, through which timber is conveyed from the feed end to the exit end of the cylidrical drum. The cylidrical drum can be equipped with means for discharging the debarked material from the inside of the drum either through the cylinder casing or together with the debarked timber. The bark is separated from the trunk part of the timber by a rubbing, wearing and/or cutting stress resulting from the reciprocal movement of logs which is effected by the rotary movement of the cylindrical drum, moving the timber. In the method according to the invention, the cylindrical drum is supported on a solid frame by elements which are at least partly flexible and suitably arranged to rotate substantially around the longitudinal axes of the cylindrical drum, whereby the debarking apparatus comprises drive means for effecting the rotary movement of the cylindrical drum. The method is used particularly to measure the volumetric efficiency in order to control the process quantities of the debarking process.

A debarking process of this kind can be considered known e.g. from the publication WO 91/17030. In particular, this publication discloses a method for measuring the degree of fullness of the barking drum which is based primarily on measuring the weight of the barking drum with the logs placed therein. The results of weight measurement are used in controlling the process quantities, particularly the position of the delivery gate of the cylindrical drum in relation to the cylindrical drum according to an elected barking

strategy. It should be noted that, in terms of measuring techniques, it is extremely difficult to determine the degree of fullness by measuring the weight of the cylindrical drum and the logs contained therein in a reliable way. As a result, measuring devices are required which are, in construction, extremely difficult to install in connection with the debarking apparatus, thus making it liable to disturbances in most practical applications.

In this invention, it was surprisingly found that in a timber debarking process where the cylindrical drum is supported against the frame by flexible elements, the measurement of the volumetric efficiency can be made in a considerably simpler and more reliable way than in the barking mechanisms of prior art. Consequently, it is an aim of the invention to raise the level of knowledge in the field, particularly with regard to debarking mechanisms which are supported on the frame by rotary elements, at least part of them being flexible. Thus, the surprising finding was made in the invention that the above-mentioned advantages are achieved by applying the method according to the invention, primarily characterized in that

- the control logistics of the volumetric efficiency related to the control of the process quantities, particularly to the elected barking strategy, are formed in a way that they are dependent on the change of form of the flexible elements and that

- the change of form of at least one of the flexible elements is measured preferably continuously during the use of the debarking apparatus for achieving at least one control quantity according to the barking strategy.

Thus, it was surprisingly found in the invention that the change of form of the flexible elements is proportional to the volumetric efficiency of the cylindrical drum. In other words, the volumetric efficiency of the cylindrical drum is a function of the change of form of the flexible elements in relation to the unloaded situation of the cylindrical drum. As a formula, this can be expressed as follows:

$$T = f(y,t),$$

wherein

T = volumetric efficiency,
y = change of form of the flexible elements at an instant t, and
t = time.

It is obvious that the functional dependence can be determined in each single case by loading tests on the cylindrical drum, or at least the theoretical formula deduced from the properties of the flexible elements, the physical measurements and weight of the drum and other factors, with the related coefficients, can be checked by corresponding loading tests on the cylindrical drum.

In an advantageous embodiment of the method according to the invention, the height position of the cylindrical drum is measured in relation to a fixed point and/or location, preferably a device connected to the frame and/or the base of the cylindrical drum. This method, measuring the change of form of the flexible elements indirectly, has the advantage that the measurement can be made in a simple way as a linear measurement of distance, with an option from a great variety of measuring devices based on various principles.

Other characteristics of the method according to the invention are disclosed in the appended dependent claims. The invention will be illustrated more closely in the following description with reference to the embodiment shown in the appended drawings, wherein

Fig. 1 is a schematic view of part of the cylindrical drum seen from aside, primarily the feed end, the apparatus applying the method of the invention being installed in connection thereto and shown partly schematically, and

Fig. 2 shows a vertical cross-section of Fig. 1.

The embodiment of the apparatus shown in the drawings comprises a frame 1 supported on a solid base A and consisting substantially of pedestals or the like, upon which each machine unit 3 of the rotary apparatus rotating the cylindrical drum 2 is supported. Each machine unit 3 comprises in this case four parallel elements 4, arranged to be radially flexible, i.e. in this case substantially in the vertical direction, and rotable around the longitudinal axis of the cylindrical drum 2. The elements 4 are preferably wheels equipped with a thick rubber coating and coupled to a common axle 5, with transmission 6a from the electric motor 6 or a corresponding drive unit of the said machine unit 3 similarly coupled thereto. The machine units 3 are arranged longitudinally on both sides of the bark receiving channel 7, as shown in Fig. 2, in a way that the median line k of the horizontal, recumbent cylidrical drum 2 is placed substantially parallel to the channel 7 in the vertical median plane of the channel. The cylindrical drum 2 can be provided with a perforation or the like, through which the barking waste, primarily the bark of the timber, is discharged into the channel 7 and/or the

barking waste is discharged from the exit end of the cylindrical drum 2 together with the debarked timber. Further, the inside of the cylindrical drum is equipped with inner transfer elements 8 which extend substantially in the longitudinal direction of the cylindrical drum 2 and are attached to the inner wall of the cylindrical drum 2. Both the feed end and the exit end (not shown) of the cylindrical drum 2 are equipped with drive means, e.g. gate arrangement with a hydraulic cylinder (not shown).

As seen from Fig. 2, the cylindrical drum 2 of the debarking apparatus brings about a certain change of form (point MM in Fig. 2) in the flexible elements 4 rotating the same even in a situation where the cylindrical drum 2 is unloaded, i.e. its volumetric efficiency is 0. Obviously, feeding logs into the cylindrical drum 2 at the feed end also increases the weight effective on the flexible elements 4. As the volumetric efficiency increases, this causes a greater change of form in the rotating flexible elements 4, which is proportional to the volumetric efficiency.

With particular reference to Fig. 1, the apparatus measuring continuously the change of form of the rotary flexible elements 4 is placed, according to the invention, in connection with the cylindrical drum 2. According to one embodiment (not shown), the apparatus can naturally be placed directly in connection with rotary flexible elements 4, but in the embodiment shown in Fig. 1, the apparatus comprises a measuring head 9 with fixed support on the base A (or alternatively on the frame 1) and being electrically connected to the control logistical unit 10 related to the choice of the barking strategy. The measuring head 9 measures the vertical distance y to the perimeter of the cylindrical drum 2 to a separate frame device 11 connected thereto and placed preferably in

a vertical position, e.g. optically and/or magnetically. The frame device 11 can be constructed in a circular shape as precisely as possible in a way that the centre is on the median line k of the cylindrical drum. The frame device 11 is thus separate from the casing of the cylindrical drum 2, which may have dimensional inaccuracies particularly in cross-sectional circularity due to manufacturing techniques and also because of the stress effect in use, and does not affect the measuring result. Alternatively, the logistical unit 10 of the apparatus can be provided with filtering circuits or the like, which are intended for filtering possible defects in the circular form. The mechanism 9, 11 can obviously be another combination for taking measurements, particularly for measuring the change of form of the flexible elements 4 in the loaded situation as compared with the unloaded situation of the cylindrical drum 2. The mechanism can be placed at several locations in the barking apparatus, whereby it is possible to obtain a total result based e.g. on the average values of the changes of form. The measuring arrangement shown in Fig. 1 is only an advantageous embodiment.

A distance value y is derived from the measuring head 9 to the control logistical unit 10 provided with the function $T = f(y_i, t_i)$ describing the volumetric efficiency and being dependent on the distance value y. The instantaneous value thus obtained for the volumentric efficiency is compared with an index value T_{as} recorded in the control logistical unit 10 e.g. according to the quality of the timber to be debarked. The index value T_{as} is at least one starting point for the desired barking strategy for achieving an optimal degree of utilization of the barking apparatus with regard to both the debarking result and possibly power consumption. The index value T_{as} can be determined by testing or by calculation. By

comparing the values $T_i=(y_i,t_i)$, in which i is an index for a certain instant, and T_{as}, a difference quality value δT is obtained, which provides a basis for regulating the drive means A, B, C etc. which, in turn, control the apparatus, such as motors 6 (rotational frequency of the cylindrical drum 2), whose feed and exit gates and other functions regulate the elected barking strategy.

From the description above, it is obvious to an expert in the field that the method of the invention can be applied in the actual measuring operation in a variety of ways. In practice, however, it is advantageous to measure the change of form of the rotary flexible elements indirectly, particularly - but not solely- as a continuous measurement of the distance between a fixed point in the apparatus and the outer surface of the casing of the cylindrical drum 2 and/or a related frame device 11 or the like in the vertical direction. From this measurement of the distance, it is easy, particularly by using the geometric dimensions of the chosen method of measuring, to calculate e.g. the absolute value of the change of form of the rotary flexible elements directly in each degree of filling. It is obvious that the rotation of the cylindrical drum can be effected also by drive means other than the rotary flexible elements, which are thus used for the purpose of support only, the force required for the rotation of the cylindrical drum being provided by other drive means. It is obvious that the method can be applied also in such barking apparatuses in which at least one of the two lines of rotary elements is made of a flexible material. The control logistical unit 10 can naturally comprise transducers, such as digital-analog based and computing circuits for monitoring the control unit. The actual distance measurement can be taken without contacting, e.g. on an optic and/or magnetic principle, but also contact-

based measuring methods, such as those based on electric resistance, are feasible. These different methods are not described in detail in the description, because they are part of the know-how of an expert in the field.

Claims:

1. Method in the process of timber debarking, wherein the debarking apparatus used comprises a rotary cylindrical drum (2), preferably equipped with transfer elements therein, through which timber is conveyed from the feed end to the exit end of the cylidrical drum (2), the bark being separated from the trunk part of the timber substantially by a rubbing, wearing and/or cutting stress resulting from the reciprocal movement of logs which is effected by the rotary movement of the cylindrical drum (2), moving the timber, wherein the cylindrical drum (2) is supported on a solid frame (1) by elements (4) which are arranged to rotate substantially around the longitudinal axes of the cylindrical drum and at least part of which are flexible, the debarking apparatus comprising also drive means (6, 6a) for effecting the rotational movement of the cylindrical drum (2), whereby the method is used particularly to measure the volumetric efficiency in order to control the process quantities of the debarking process, characterized in that

- the control logistics of the volumetric efficiency related to the control of the process quantities, particularly to the elected barking strategy, are formed in a way that they are dependent on the change of form of the flexible elements (4) and that

- the change of form of the flexible elements (4) - at least one of them - is measured preferably continuously during the use of the debarking apparatus for achieving at least one control quantity (A, B, C) according to the barking strategy.

2. Method according to claim 1, characterized in that the method is used to measure the height position of the cylindrical drum (2) in relation to a device (9) attached to a fixed point and/or a location, preferably the frame and/or base (A) of the cylindrical drum (2).

3. Method according to claim 1 or 2, characterized in that

- at least one measuring zone, particularly a frame device (11), is placed on the cylindrical drum (2), preferably on the outer surface thereof, and

- at least one measuring element, such as a measuring head (9) is fixed in relation to the measuring zone, particularly the frame device (11), to measure the distance between the frame device (11) and the measuring element, such as measuring head (9), and

- the measuring element, such as measuring head (9), is connected to the control logistical unit (10) of the barking process, or the like, for using the distance data (y_i, t_i) in the control of the barking process.

4. Method according to one of the claims 1 to 3, characterized in that

- an index value (T_{as}) is recorded in the control logistical unit (10) or the like, which is calculated and/or measured particularly to correspond to the optimal operational value of the barking process according to a certain barking strategy, and that

- a measuring value $T_i = f(y_i, t_i)$ based on the change of form of the flexible means (4) - at least one of them - is compared with the index value (T_{as}), a difference quality value (δT) derived thereof being used in the control of the actuators of the elements carrying out the barking strategy.

5. Method according to one of the claims 1 to 4, characterized in that the measurement is taken by non-contacting measuring principle, e.g. optically and/or magnetically.

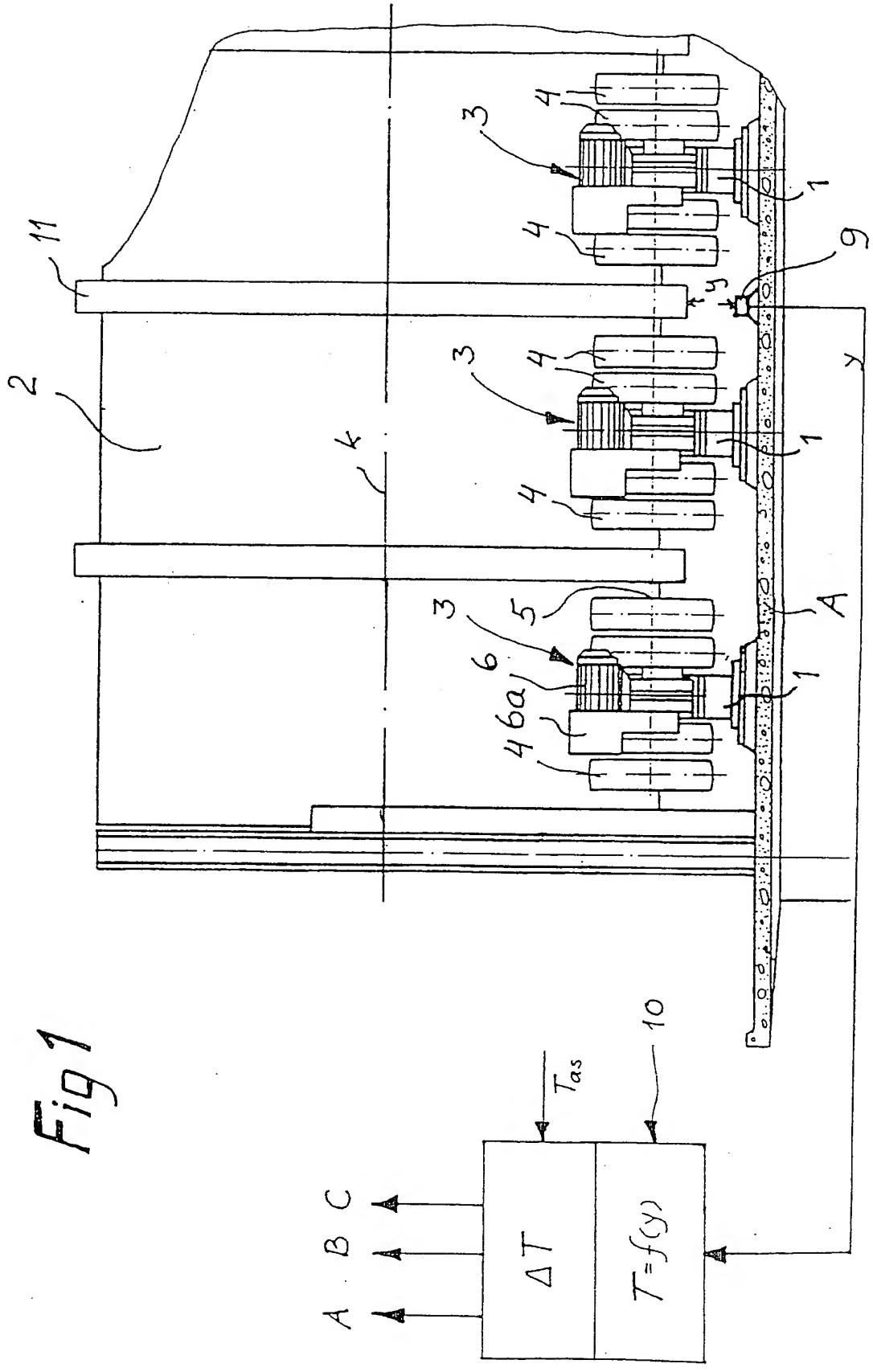

Fig 1

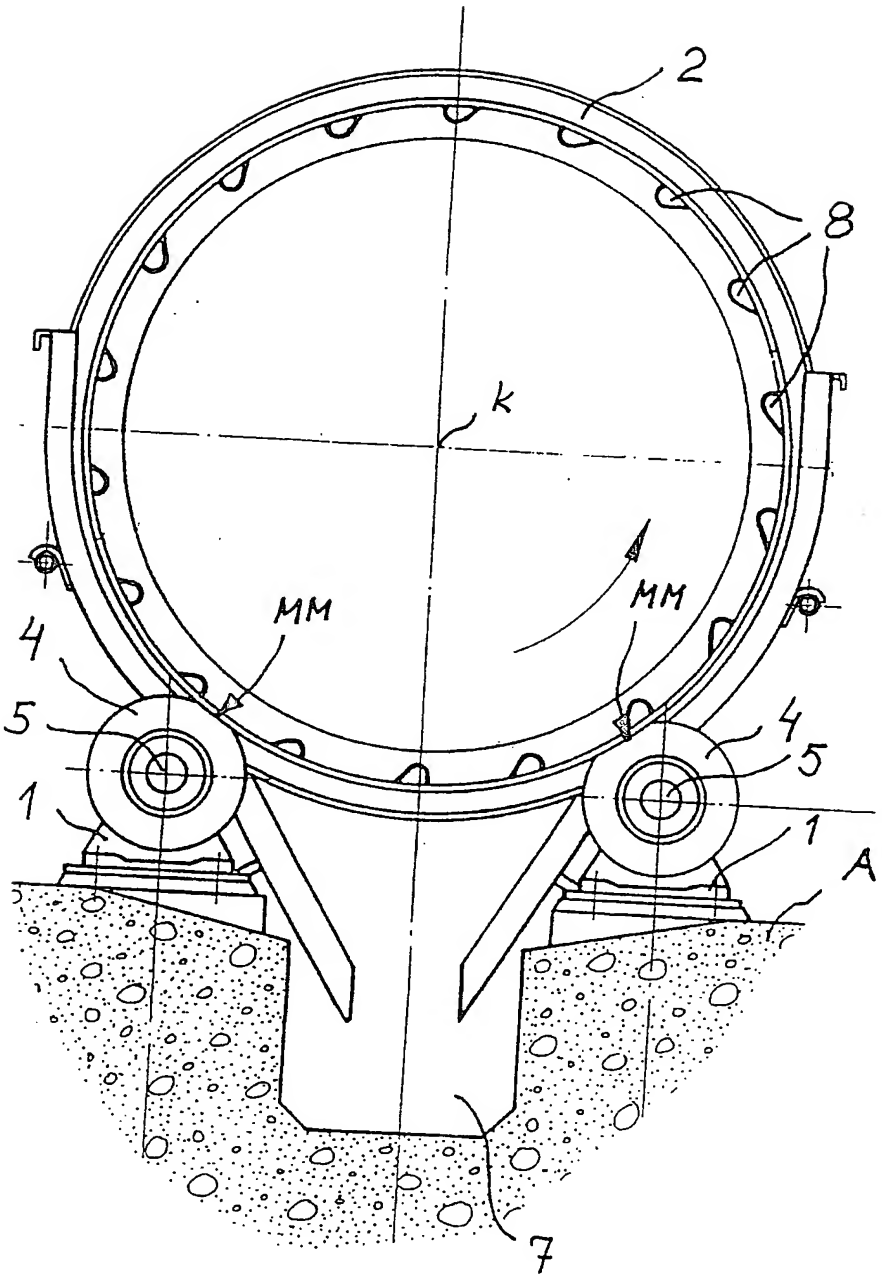

Fig 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 93/00348

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: B27L 1/04
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: B27L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO, A1, 9117030 (KONE OY), 14 November 1991 (14.11.91), figures 2b,2c, claims 1-8, abstract	1-5
Y	SE, B, 454758 (KONE OY), 30 May 1988 (30.05.88), page 10, line 13 - line 32, figure 4, claims 3,10	1-5
Y	SE, B, 431950 (MASCHINENFABRIK ANDRITZ AG), 12 March 1984 (12.03.84), figure 1, claim 1	1-5

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 3695319 (ROLF ERIK TUUHA), 3 October 1972 (03.10.72), figure 1, claim 1, abstract -- ---------	1-5

INTERNATIONAL SEARCH REPORT

Information on patent family members

16/10/93

International application No.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A1- 9117030	14/11/91	CA-A- 2063377	03/11/91
		US-A- 5247978	28/09/93
SE-B- 454758	30/05/88	SE-A- 8401927	07/10/85
SE-B- 431950	12/03/84	AT-A,B- 341192	25/01/78
		DE-A,B,C 2709835	15/09/77
		FR-A,B- 2343569	07/10/77
		SE-A- 7702550	09/09/77
US-A- 3695319	03/10/72	SE-B,C- 370519	21/10/74

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